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[56] Prior printed publications to be taken into consideration for the evaluation of the patentability:

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The following statements were taken from the documents submitted by the applicant

54 Process and Arrangement for Writing on the Surface of an Object

57 A process is described for writing on a surface of an object by utilizing bundled energy.

Through that, a substance which produces the writing is supplied to the location on the object at which the bundled energy is directed.

Description

The invention concerns a process for writing on a surface of an object, with the characteristics of the preamble of claim 1.

It is known to make marks with a laser beam on the surface of an object of metal or synthetic material. Without additional prior measures on the basis material one achieves hereby an only poor contrast to the basis material and with that only a poor legibility. One is therefore forced to permanently apply certain materials into or onto the basis material, but at least into the surface. Contrasting agents are often also applied later into the, e.g., engraved surface in order to achieve visible markings.

The object of the invention is to achieve a higher and more targeted contrast and by that a better legibility without special measures on the basis material.

This object is achieved through the characteristics in claim 1.

The subclaims comprise embodiments of the process according to the invention and arrangements' for performing the process.

Different gray tones or colors can be preselected through the invention. The focusing of the energy at the surface of the body (synthetic material, metal) is used for the application or conversion of the object's surface, as well as for the conversion of the substance supplied and for the interaction (e.g., mixing or alloying). Through that one achieves the desired "permanent writing" on a surface or a material which was neither previously nor afterwards treated to be especially durable, and one simultaneously has the choice of the gray tone or color selection of the marking.

With synthetic material surfaces it is advantageous to dry-apply polymer particles (similar to the "toner" in laser printers with particle diameters of approx. 6-15 μm) with incorporated color pigments. Smaller particles ≤ 5...6 μm tend towards "the formation of dust" and must therefore be applied onto the desired surface to be labeled using supplementary measures. For that, the particles are often embedded (distributed uniformly) into a more or less viscous and preferably transparent carrier fluid which is easy to apply and to remove. With such measures, the particles are manageable up to "nanometer" dimensions and offer many possibilities for the writing (marking) according to the invention. The dry particles are advantageously provided in the supply device with electric charges, and the feeding and holding on the surface during the writing process are

supported through appropriate electric fields. Electric field forces can then also be used advantageously during the removal of the loaded particles (which were not used up during the "writing"). The portion of material not affected is usefully vacuumed away (or wiped off or brushed off). During the writing process, both materials, i.e., the surface of the object and the supplied substance melt together and by that form a durable[2] mark on the surface.

With metal surfaces, thin layers of various colors may be produced at the surface, e.g., with appropriate gas compositions and appropriate laser beams (appropriate wavelengths or pulse modes), such that the writing may be laid out as desired and is characterized by extremely thin layers and high durability.

One may naturally apply also polymer marks on the metal surface, similar to the synthetic material layers, which as a rule do not have the extreme durability, but may advantageously be removed by special cleaning. This is useful if through this process, the durability of the mark in the case of utilization is sufficient. Furthermore, the writing can then be removed as desired through special cleaning and labeled again.

Metal powders with different additives similar to the synthetic material layers, which are characterized through high durability of the writing, may also be used advantageously.

With this substance/gas supply into the energy beam on the surface one may mark any material (e.g., metal, glass, synthetic material) in various gray and color scales, without requiring special material properties of the basis material with respect to the desired color tones. This eases not only the fashioning of the marking by writing (gray tone, color), but rather durable markings may be applied onto a large number of materials, without special measures prior to or after the writing, at any point in time (e.g., onto already existing parts in a machine), that means also outside the place of production.

In this process it is useful to install the "substance/gas supply", the "energy supply" and the "substance/gas removal", i.e., the cleaning within one device. With that one has a complete writing head for gray and color tones and one is able to apply the permanent writing at any location and at any point in time, onto almost any number of materials. This also has advantages where other processes are utilized for large number of pieces

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[1] or *devices*
[2] or *permanent*

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(e.g., printing), where however a flexible labeling is desired later as indicated by the situation (e.g., country label, operating consoles, IC-cards, etc.).

Under substance one understands here: solid small particles (polymers or metals), gas or gas mixtures, particles (polymers or metals) in a fluid carrier substance.

The energy beam may be deviated in X and in Y direction. But it is also possible to move it in only one direction (e.g., X) and displace the writing head itself translationally into the other direction (Y). Through that one is more flexible in the design of the writing head. In this case, the length of the writing is only dependent of the transport path of the device and the object to be labeled must not be moved.

The supply-removal/cleaning device will usefully be designed as line element, i.e., the supply/removal device works over the entire width of the writing.

Examples of embodiment of the invention are explained by means of the drawing. The [figures] show:

Fig. 1 an example of embodiment for explaining the principle of the invention,

Fig. 2 a representation for explaining the mode of operation of the writing head.

Designated with **1** in **Fig. 1** is an object to be labeled on a surface **2**. A laser beam **3** of a laser beam generator **4** (or a bundled electromagnetic field) acts on the surface **2**. Gas or particles in the form of powder (e.g., polymer or metal powder) are further blown (material supply and blower **5**) onto the [area] surrounding the location on which the laser beam acts. On the other side lies a suctioning device **6**, which suctions off the "substance" that was not used up. At the place of impact of the laser beam, a durable writing is created through this [beam] and the supplied substance.

Any desired writing is created through the movement of the object 1 in two coordinates with respect to the writing head **4**, **5** and **6**, or of the head **4**, **5** and **6** in relation to the object **1**.

Fig. 2 shows an object **11** which in the printed image **12** it is to be labeled having the width of the array **b**. One may now deviate the laser beam in known ways in the direction of the arrows **13**. In this case it is useful to shape the supply and removal device/cleaning device as line element, i.e., they act on the writing line of the laser and in particular on the entire width of the array. The other coordinate (arrow **14**) is achieved by shifting the entire writing head.

It is finally also possible to deviate the laser beam in both coordinate directions. Here, the entire array to be labeled must then be supplied with substance and cleaned at the same time.

Patent Claims

1. Process for labeling the surface of an object by using bundled energy, **characterized in** that a writing-causing substance is supplied to the location of the object at which the bundled energy is directed.

2. Process according to claim 1, characterized in that the substance is a gas/gas mixture.

3. Process according to claim 1, characterized in that the substance consists of powder particles.

4. Process according to claim 2 or 3, characterized in that the substance is blown/blasted onto [the surface].

5. Process according to claim 1, characterized in that the substance consists of particles which are embedded in the fluid carrier material which is applied.

6. Process according to one of the claims 1 through 5, characterized in that excess substance is removed (vacuumed, brushed or wiped off).

7. Arrangement[3] for performing the process according to one of the claims 1 through 6, characterized in that the bundled energy is a laser beam.

8. Arrangement for performing the process according to one of the claims 1 through 6, characterized in that the bundled energy is an electric field.

9. Arrangement according to one of the claims 7 or 8, characterized in that the energy generator and the substance supply are combined in one writing head.

10. Arrangement according to claim 9, characterized in that the cleaning device is also accommodated in the writing head.

11. Arrangement according to one of the claims 9 or 10, characterized in that the bundled energy is deviated in the direction of one coordinate and the writing head into the direction of the other coordinate.

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[3] or *device, instrument, tool*

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12. Arrangement according to claim 11, characterized in that the device supplying the substance and the cleaning/vacuuming device are designed as line element with a width equal to at least the width of the writing.

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